Comments on Risk-Based Preliminary Remediation goals (PRGs)
Presented in the Interim Submittal of
Responses to EPA's Comments of December 22, 1993
on West Lake Landfill Work Plan and Related Documents

1. Page 5-9, second paragraph. This paragraph states that risk-based PRGs calculated using default values are presented in Table 5-2, and then goes on to state these PRGs are presented in Table 5-1. Table 5-1 presents Contaminants Of Concern and Preliminary Remedial Action Objectives (PRAOs) for the media of concern.

2. Table 5-1. COCs for air should include organics/inorganics in fugitive dust.

3. Table 5-2, page 1 of 3. The oral RfD (RfD_o) has been used as the inhalation RfD (RfD_i) for several compounds: acetone, bis(2-ethylhexyl) phthalate, hexachlorobenzene, phenol, chlordane and dieldrin. ~~Is this appropriate~~? Use of the RfD_o as the RfD_i may result in the calculation of a PRG that is not protective of human health.

4. Table 5-2, page 1 of 3. The PRG for lead in tap water should be 15 ug/L.

5. Table 5-2, page 1 of 3. Please indicate the source for the RfD_o/RfD_i used for 4, 4' DDD in Table 5-2. A value of $5x10^{-4}$ has been presented. D

6. Table 5-2, page 1 of 3. Please provide contaminant-specific soil-to-air volatilization factors (VF) used in calculating noncarcinogenic and carcinogenic PRGs for non-radioactive volatile and semi-volatile contaminants in soil.

7. Table 5-2, page 2 of 3. The oral RfD (RfD_o) has been used as the inhalation RfD (RfD_i) for two compounds: endrin and HCH (gamma) Lindane. Use of the RfD_o as the RfD_i may result in the calculation of a PRG that is not protective of human health.

8. Table 5-2, page 2 of 3. The PRG for HCH (gamma) Lindane in tap water should read 0.2 ug/L MDWR.

9. Table 5-2, page 2 of 3. The correct units for the external exposure cancer slope factor (SFe) for radionuclides is risk/year per pCi/g of soil.

10. Table 5-2, page 3 of 3. The equation shown for calculating PRGs for radionuclides in commercial/industrial soil is incorrect. Because the Office of Radiation Programs has changed the way it calculates slope factors, EPA revised the equations presented in RAGS (Part B) for calculating PRGs for radioactive contaminants in commercial/industrial soil. EPA now uses two equations to calculate PRGs for radionuclides in commercial/industrial soil. These equations are as follows:

Nonvolatiles

$$\text{Risk-based PRG (pCi/g; TR} = 10^{-6}) = \frac{0.000001}{[(3.1\times10^{2}\ (SFo))]+(2.7\times10^{-2}(SFi))+6(SFe)]}$$

Volatiles

$$\text{Risk-based PRG (pCi/g; TR}=10^{-6}) = \frac{0.000001}{[(3.1\times10^{2}(SFo))+((1.3\times10^{8}/VF+2.7\times10^{-2})(SFi))+6(SFe)]}$$

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RESPONSES TO EPA's COMMENTS OF DECEMBER 22, 1993 ON THE WEST LAKE LANDFILL WORK PLAN AND RELATED DOCUMENTS

SPECIFIC COMMENTS

12. Figure 3-1, Page 3-2

The legend for Figure 3-1 should identify the boundary for the regulated landfill. This figure or an alternate figure should identify the approximate extent of bedrock quarry activities. This information is very important in regard to understanding site conditions and will assist in proper scoping of the groundwater characterization.

Response: The boundary for the regulated landfill (approximate extent of bedrock quarry activities) has been indicated on Figure 3-1.

13. Figure 3-2, Page 3-3

The figure does not include the surface water body north of Area 2 and does not identify the regulated landfill area.

Response: The north water body and boundary of the regulated landfill area have been added to the figure.

14. Figures 3-1 and 3-2

The GB series of borings have been omitted from all figures. However tables throughout the WP and FSP still identify the GB series of borings.

Response: The GB series of borings have been removed from Table 3-2.

15. Section 3.2, Page 3-4

The proposed survey grid is 30' x 30' for the radiometric survey. The text should provide a contingency (with procedures defined) for indicating that survey observations/sampling points may be collected between grid points for the purpose of defining suspected source areas more accurately.

Response: Description of a sampling contingency has been added to the Sampling and Analysis Plan.

16. Table 3-1

The "water-bearing character" of the Meramecian Series (St Louis/Salem Formations) is not completed. As St Louis/Salem limestone is the bedrock on which Site alluvium is founded, these details would be useful.

In addition, as the Warsaw Formation may be an aquitard (stated in section 3.3.2.1). The word "shale" should be provided in the "dominant lithology" column, and "possible aquitard" in the "water-bearing characteristics" column.

Response: Table 3-1 has been modified to include the suggested information.

17. Section 3.2.2.1, Page 3-6

The text states that alluvial aquifers recharge the bedrock aquifers. This is misleading as it implies that the Ordivician and Cambrian aquifers, in the vicinity of the Site, are recharged directly from the overlying alluvium, which is more than 1000 feet higher in the section. The implication is even more confusing because Table 3-1 indicates that one, and possibly two, confining units are contained within this 1000+ feet section.

The text should state that the deep bedrock aquifers are recharged directly

- By surface water in areas where the bedrock strata are exposed, or
- Through the alluvium in areas where truncated limbs of deformed bedrock are disconformably overlain by alluvial aquifers.

The text should also have noted that the nearest recharge areas are located several miles to the east of the Site.

Response: Work plan section 3.2.2.1 text revised to include recharge information.

18. Figure 3-8, Page 3-14

a. Please explain why the reported bedrock depths from the Burns & McDonnell (B&M) report were changed when reported in the workplan (i.e., D-93). The bedrock isopleth map appears to be accurate from the center of the landfill site to the quarry but fails to show the flattening of bedrock surfaces near Area 2. The 330' contour line should be much closer to this location. Please re-evaluate contour lines.

Response: The top of well casing elevations were inadvertently used by Burns & McDonald and McLaren/Hart in calculating the bedrock elevations. All bedrock elevations have been re-calculated using a ground surface datum. The map has been revised.

b. The boring log for D-92 in the appendix does not describe the lower 32 ft of borehole stratigraphy which is in the B&M report.

Response: The missing copy of the boring log has been added to the Appendix.

19. Section 3.3.2.1, Page 3-15

a. The third paragraph states, ...groundwater surface elevations appear to coincide with the Missouri River stage. Did this prove to be true during the recent (summer 1993) flooding? If true, the groundwater table would have been located within the fill materials leading to probable dissolution and remobilization of contaminants. If remobilization has occurred, the data on which the investigation has been formulated may not be accurate.

Response: With regards to the relationship between groundwater elevations beneath the Site and the Missouri River stage the text of the report has been changed as follows: "Groundwater elevations vary on a seasonal basis and generally fluctuate between elevations of 430 and 438 feet MSL. Water level rises are associated with periods of high precipitation. Coincident with the precipitation is a rise in the Missouri River stage."

Groundwater elevation data collected during the summer of 1993 are included in the work plan. Data show, as expected, an increase in groundwater levels in the monitoring wells. The water levels measured were the highest recorded to date and were 2.21 to 6.55 feet higher than the highest levels previously recorded. In monitoring well S-84, which is located near Area 1, the depth to water was 20.52 feet and a water level rise of 2.44 feet was observed. Fill was reportedly encountered to a depth of 22 feet during the drilling of this well. Re-sampling of this well and other wells on the property as part of the implementation of the work plan will determine if the water rise into the fill has adversely impacted water quality.

b. The text should be expanded to discuss fluctuations in the groundwater table caused by local (manmade) influences. Additional information should include but not be limited to:

- Are the stormwater retention ponds lined? If not, why are mounding effects not shown?

- Are dewatering wells used to keep the former quarry area dry? If dewatering wells are not used, the groundwater elevations shown in Figure 3-10 would drive groundwater into the excavation; it is doubtful if the limestone (fractured?) would form an effective barrier to over 100 feet of reported hydraulic head. If dewatering is being implemented, please explain why the effects are not seen in the groundwater contours?

Response: The storm water retention pond, west of the property is not lined. The pond located north of Area 2 is also not lined, nor is the drainage ditch along St. Charles Rock Road which drains into this pond. The treatment pond located west of the former quarry is lined. Groundwater elevation data for March 30, 1985, and August 8, 1985, were contoured to determine groundwater flow direction beneath the property and to determine possible impact from local, manmade features. Based on review of the contour maps, groundwater recharge from the treatment pond and the storm water retention pond may

be occurring. Groundwater contour data also indicate that surface water run-off and ponding of rain water on the property may be locally acting as a source of groundwater recharge.

Eight wells are located in the former quarry for leachate control. The effects of dewatering for leachate control within the regulated landfill is expected to be minimal outside of the landfill. This is because the landfill is situated within the former limestone quarry. The quarry is located east of the edge of the valley alluvium, and is minimally impacted by groundwater which is present in the alluvium. Additionally, the limestone surrounding the former quarry was pressure grouted prior to the operation of the landfill to minimize potential groundwater seepage, and the sidewalls of the quarry have been lined with a 12-foot thick compacted clay liner.

With respect to the ability of the limestone to form an effective groundwater barrier, we refer you to a letter prepared by Thomas J. Dean, Chief, Engineering/ Environmental Geology, Missouri Geology & Land Survey, dated January 22, 1985. In this letter Mr. Dean states "... the rock in the quarry is relatively water tight in that over 200 feet of head differential apparently exists between the alluvial water level to the west and bottom of quarry ....". This letter was written after Mr. Dean visited the site and reviewed a set of plans and report pertaining to the expansion of the regulated landfill into the quarry.

20. Figure 3-3, Page 3-8

The surface water body north of Area 2 is not identified on Figure 3-3. All figures identifying surface water should include the identification of the surface water body north of Area 2.

Response: Figure 3-3 and other figures identifying surface water have been revised to include the north water body.

21. Figure 3-8, Page 3-14

a. Please explain why the bedrock depths from those reported in the B&M report are different from those reported in the workplan. The bedrock isopleth map fails to show the flattening of bedrock surfaces near Area 2.

b. The 330' contour line should be much closer to the location of monitoring well D-83.

Response: The figure has been revised. Please see response to comment #18.

22. Section 3.3.2.1, Page 3-15, last paragraph

The text states "Figure 3-10 depicts the typical groundwater gradient across the West Lake Property. As indicated by the figure, localized variations to this general flow direction do occur." The text should be expanded to include a summary of why the localized variations may occur. The summary should discuss seasonal variations and the source of the water level data and note any differences or consistencies between the data sources. The B&M report contains ample groundwater level monitoring data for constructing seasonal groundwater contour maps. A selection of groundwater level data from months which represents the spring and fall seasons (i.e., March and August) should be used to develop groundwater contour maps for each month. Do not rely on computer generated contour maps.

Response: Groundwater data from March and August 1985 have been contoured and are included in the revised work plan. The text has been re-written and expanded to include possible explanations for the observed conditions. Pertinent portions of the revised text which relate to this comment are as follows:

"The overall groundwater flow direction beneath the Site is to the northwest. Figures 3-10 through 3-15 present groundwater contour maps for data collected on March 30, 1985, and August 8, 1985, for the shallow, intermediate, and deep monitoring wells. Groundwater contour data show essentially the same overall pattern within all three well completion depths. Seasonal changes in groundwater flow direction are not apparent based on comparison of the groundwater contour maps."

The groundwater contour maps we have prepared differ from those presented in the Burns & McDonnell (1986) report. Burns & McDonnell's interpretation is based on combining the shallow and intermediate depth wells to produce one contour map. Our interpretation is based on separate contour maps for the shallow, intermediate depth, and deep wells.

"Review of the groundwater contour maps shows that a groundwater trough is present beneath the Site. This trough is oriented in a northwesterly direction. Groundwater flow is directed towards the center of the property and exits on the north, beneath Area 2.

There are several possible explanations for the groundwater trough. Two likely explanations are as follows:

- Drainage ditches and ponds surround the perimeter of the property. It is possible that these surface water bodies are recharging groundwater. If groundwater recharge mounds are present beneath these features, then you would expect a groundwater trough similar to that observed.

- The regulated landfill is located in the southern portion of the Site. The landfill is located in the former limestone quarry, and the limestone immediately adjacent to the quarry was pressure grouted prior to construction of the landfill. If the former quarry is acting as a non-

permeable mass (groundwater obstruction), then groundwater flow will diverge as it approaches the quarry. On the downgradient side of the quarry, groundwater flow will converge. This will result in a groundwater trough similar to that observed.

It is reasonable to expect that a combination of both of these explanations are the cause of the groundwater trough. The groundwater data indicate that groundwater recharge may be occurring from the treatment pond and storm water retention pond which are located on the west. Data also suggest that surface water runoff and localized ponding on the property may be a source of groundwater recharge.

"Surface exposure of groundwater can occur in the form of seeps and springs. Based on review of previous investigation reports and correspondence, no springs are present on the property. Seeps have been locally observed on the walls of the limestone quarry, and also near the toe of the berm on the west side of the property. The seeps within the quarry have been mitigated by the pressure grouting. Future seeps in the berms can be expected to occur in areas of poor surface drainage and localized ponding of rainwater."

23. Section 3.3.2.2, Page 3-31

a. The surface water body north of Area 2 is identified but no information presented from previous reports and no summary by MH was presented. The text does not provide adequate information to determine the appropriate sampling necessary to characterize the surface water body. It appears MH has not evaluated the previous data collected during previous investigations, therefore, information has not been presented relating to the surface water body. The text should be expanded to discuss the impact by surface water runoff from the site, groundwater discharge and leachate throughflow.

Response: The text has been revised and expanded to include a discussion on the pond located north of Area 2 and the impact of surface water runoff. To our knowledge, the surface water body north of Area 2 has not been addressed in previous reports. Pertinent revisions which relate to this comment are as follows:

"Review of historic aerial photographs of the Site show several surface water drainages were present on the northern portion of the property prior to development. These drainages are oriented in a northerly direction and are directed toward the surface water body located north of Area 2. Portions of these drainages are now covered by Area 2.

The aerial photographs show also that the shape of the pond north of Area 2 has changed over time. The improvements most-likely occurred concurrent with the excavation of a pond on the neighboring property located on the opposite side of St. Charles Rock Road. Figure 3-16 is an aerial photograph of the Site with an overlay showing the location of the former drainages, the improved pond, and the current topography on the Site."

"Areas 1 and 2 are covered with a layer of clean soil. Surface rainwater runoff is not expected to mobilize contaminants which may be present beneath these areas. Based on topography, a severe and prolonged rainfall may lead to erosion of the soil cover in the lower elevations of Area 1. Erosion of the soil cover and mobilization of the underlying contaminants may potentially occur if the soil cover is not of adequate thickness.

Ponding of rainwater on the ground surface at the top of a berm may lead to the saturation of the underlying soil, and ultimately a slope failure. Ponding and surface water infiltration under the proper conditions may also lead to the development of seeps along the face, or the toe of the slope. If infiltration occurs in the immediate vicinity of the former drainages which are present beneath Area 2, then the former drainages may act as a potential conduit for more rapid movement of the contaminants, and discharge into the pond north of Area 2."

b. The staff gages to be placed in appropriate surface water bodies and monitored should be located on a figure. The gage must be fixed to a permanent structure. The text should expand on where the gages will be located and what procedures will be used for placement and frequency of monitoring.

Response: This comment has been addressed by changes in the text within the Sampling and Analysis Plan.

24. Section 4.2, Page 4-2, third paragraph

This paragraph states that the primary chemicals of concern are the radionuclides. It goes on to state that organic/inorganic contaminants do not appear to be of concern at the Site. Because the site is a landfill and the wastes are not well-defined, it is premature to rule out organics/inorganics as potential chemicals of concern. For risk assessment purposes, contaminants exceeding detection limits and background concentrations are retained as potential chemicals of concern. Please refer to the data from the B&M report for chemicals of potential concern and list them in a table.

Response: The radionuclides and chemicals identified in the AOC and/or reported by B&M as being detected at the site have been identified as the chemicals of concern and listed in a table in Section 4.2 of the work plan.

25. Section 4.5, Page 4-6

The text states "While some information has been interpreted by USEPA to allege that industrial waste has been disposed at the Unregulated Landfill, available documentation indicates that municipal and demolition waste was disposed in this Unregulated Landfill. This is supported by analyses of groundwater from monitoring wells." There is no discussion of the data from previous investigations. Contaminants were identified in groundwater during previous sampling events. Information supporting the fact that only municipal and demolition waste was disposed in this Unregulated Landfill should be provided to EPA.

Response: The text has been revised to address the possibility that liquid industrial waste may have been disposed in the Unregulated Landfill to make it consistent with information obtained from our review of the 103 response files and aerial photos. Review of previous sampling data does not indicate significant priority pollutant contamination in groundwater; however, detectable concentrations of several organic and inorganic constituents have been documented.

26. Section 4.5, Page 4-6, fourth paragraph

This paragraph states that soil mixed with leached barium sulfate raffinate was disposed of on a portion of the Site. Again it must be noted that leached barium sulfate is not raffinate. The term raffinate should be deleted.

Response: The term raffinate has been deleted.

27. Section 4.5, Pages 4-6 through 4-8

a. The conceptual model as presented is very general in nature. There is little or no discussion of potential rates of migration or the types/sensitivities/numbers of human receptors. Additionally, there is no mention whatsoever of environmental receptors.

Response: Section 4 has been restructured and revised and now includes an indication of the migration potential for the materials of concern and a discussion of the potential receptors to be considered in the evaluation.

b. The conceptual model should build a foundation on which contaminant migration could be inferred:

- Groundwater and soils in the Midwest can exhibit anomalously high radioactivity due to naturally occurring thorium and radium. The workplan should discuss how background conditions and locations will be identified, current background conditions that meet these criteria, needs for additional background sampling, and where background samples might be collected to meet this need.

- The text should describe the contaminants of concern and their migration characteristics (for example, uranium is present and readily forms soluble carbonate complexes under alkaline Ph conditions; radioactive daughters of radium include radon gas which can diffuse upwards through the vadose zone to the atmosphere, etc).

- The text should describe transport mechanisms for the contaminants (for example, soluble uranium species carried downward to the water table by surface water infiltration, the presence of interlayered clay strata impede the downward migration of soluble contaminants etc.)

- A discussion of possible migration routes and release mechanisms due to remediation efforts might be useful. For example, excavation may be undertaken which could lead to airborne releases of radionuclides that are currently stabilized under the existing soil cover.

- Detailed information requested from previous comments in the comment letter dated July 12, 1993 by EPA were not addressed (i.e., review of aerial photos,).

Response: A discussion on background sampling locations has been added to Section 6 of the work plan. Section 4 text now includes a discussion of the migration potential of materials and the various transport mechanisms that may be relevant at the site. Aerial photos were reviewed and are referred to in Section 3, Site Characterization, and also in the selection of sampling locations discussed in Section 6.

c. The conceptual model of regional groundwater flow patterns is not convincing. Local flow patterns (Figure 3-11) appear to be towards the northeast (as stated in the comment) and not to the northwest as stated in the text. The text should be expanded to address the inconsistencies between Figure 3-11 and the text.

- The WP claims that the figure was constructed using appropriate methods and never addresses the obvious inconsistencies .

- No attempt has been made to introduce groundwater data that show dominant regional trends.

- No attempt has been made to introduce groundwater data that show dominant seasonal trends.

- The local effects of the stormwater retention facility and treatment pond have not been addressed.

- Computer generated models using "time-series average" data may be acceptable for well-characterized sites but in this case, professional interpretation may have been more appropriate with the data available.

Response: The conceptual model as discussed in comments #19 and #22 is based on groundwater elevation data collected on specific dates. In our response to these comments we have discussed groundwater flow direction and the apparent lack of seasonal variation, even though groundwater levels fluctuate as much as 7 feet during the course of the year. We also discussed the various ponds and surface water bodies and their possible impact on groundwater flow.

d. The conceptual model suffers from oversimplification of the process and the waste that was transported to West Lake Landfill. Saint Louis Site documents have related that the 39,000 tons of soil were reported to have been scraped from the surface of the Latty Avenue property. Even after removal of this soil,

subsequent surveys of the Latty Avenue property found substantial surface contamination there, much of which was scraped up to form the original nucleus of the main engineered storage pile that is present there now. Accordingly, this soil, scraped from the surface at the time of the disposal in West Lake landfill, can be assumed to have been highly contaminated with the various raffinate residues that were handled, stored, and dried at the Latty Avenue property -- in addition to being contaminated by the leached barium sulfate cake. Further, because of the great bulk of the 39,000 tons of soil scraped from the surface, there is a great deal of uncertainty in how well the soil and the barium sulfate were mixed together. The homogeneity or heterogeneity of the resulting waste has not been adequately characterized. The conceptual model should be revised to more comprehensively and accurately encompass likely site conditions and contaminants.

Response: Section 4.1 of the September 2, 1993, Draft Work Plan makes reference to the lack of information regarding the characteristics of the radioactively contaminated soil, and the degree of mixing which occurred prior to placement in the landfill. Similar statements are re-iterated in the conceptual model section of the revised work plan.

28. Section 5.1, Page 5-1

RI Objectives should be consolidated to remove redundancy and the following items should be added:

- Determine the extent and magnitude of onsite radiological and nonradiological contamination in Areas 1 and 2
- Determine the extent and magnitude of offsite contamination identify contaminant migration pathways and barriers
- Evaluate the hydrogeologic characteristics of the alluvial and bedrock aquifers
- Describe onsite and offsite features (including utilities) that could affect implementation of remedial measures
- Describe background soil and groundwater quality
- Determine groundwater head distribution and seasonal variations
- Determine groundwater conductivity parameters
- Develop a conceptual model of groundwater/hydrostratigraphic relationships,
- Determine contaminant and groundwater boundary conditions

- Characterize the soils beneath and adjacent to the landfill for geotechnical and hydrogeological properties that could affect selection of a remedial alternative, and

- Describe the relationship between groundwater and surface water flow.

Response: Suggested revisions to the RI objectives have been incorporated in Section 5.1.

29. Section 5.2.1.3

a. There is no contingency provided for sampling perched water above clay aquitards, if present. Please expand the text to include such contingencies.

Response: The text has been revised to include sampling and analysis of perched water which may be encountered during the drilling of the soil borings. The revised text states "If perched water is encountered during the drilling of the soil borings, then an effort will be made to collect a sample using a hydropunch for laboratory analyses."

b. What criteria will be employed to determine if a lower aquifer well is to receive a 10 foot or a 20 foot screen?

Response: Discussion of screen length, slot size, and gravel pack is included within Section 6.4.3 of the Work Plan and also in the Sampling and Analysis Plan.

The text in the Sampling and Analysis Plan has been revised to indicate that the shallow alluvial wells will be screened across the top of the groundwater surface. The well screen length for these wells will be 20 feet and will extend 10 feet above, and 10 feet below groundwater surface, as indicated by saturated soil conditions encountered during the drilling of these wells. Intermediate depth and deep alluvial wells will be constructed with a 10-foot screen length.

c. The text states "Biased locations have been selected by USEPA". EPA suggested locations as related to specific data gaps identified based on our review of past investigations and aerial photos. EPA presented the suggested locations to stress the importance of aerial reviews and review of previous data. We requested MH to review the data and aerials in order for them to identify biased sampling locations based on their scoping activities. It is the responsibility of MH to present the sampling locations for EPA review and approval. The text should be revised and MH should identify all sampling locations on their review of the aerials, data from previous investigations, and if necessary based on current information obtained in the field. The sampling locations and rationale should be presented to EPA for review and approval.

Response: The text has been revised. Appropriate sections of the revised text are as follows:

"Soil borings will be drilled within and immediately around the perimeter of Areas 1 and 2. Soil borings will be located at radiological "hot spots", as determined by the planned overland gamma survey, and at other biased locations, as identified from review of historical aerial photographs by McLaren/Hart and data from previous investigations. Soil borings will also be placed at locations within Areas 1 and 2 using a stratified random selection scheme to evaluate the overall character of these landfill deposits. In the event that no locations of elevated surface radiation are identified, additional sample locations will be selected using the stratified random selection scheme."

"Soil borings drilled at the perimeter of Areas 1 and 2 will be completed as monitoring wells. These perimeter borings/wells will be biased sampling locations, and located based on our current understanding of groundwater flow conditions beneath the Site. The planned perimeter monitoring wells will be completed as shallow, intermediate depth, and deep alluvial wells.

During drilling of the monitoring wells, soil sampling within the saturated zone will be performed for lithologic purposes only; no chemical analyses are planned at this time. The need to retain selected soil samples for laboratory analyses will be reconsidered during drilling activities, and will be based on visual evaluation and field monitoring of the soil samples." (Please refer to comment #70 for examples of visual criteria.)

30. Section 5.2.2

a. There is no discussion in the workplan or the FSP on how background is to be determined in all environmental media (e.g., groundwater, soils, surface water, sediment and air). The text states that the Phase I results are to be compared to background. The locations for the background samples must be presented in the FSP and discussed in the workplan. The criteria that will be used to establish "background conditions" must be defined in the WP and FSP.

Response: The approach to establishing background in each of the environmental media to be sampled is described in Section 6 of the work plan.

b. The goals and unanticipated conditions should be discussed with contingencies identified which could result in supplemental activities that may be proposed for Phase II investigation. The paragraph as written in the text is to general and does not provide information on who will decide whether a Phase II investigation is necessary and how their decision will be based.

Response: This section of the plan has been deleted and sampling contingencies are now described throughout the discussion of the various sampling activities. Section 6 text now indicates that the planned investigation is designed to be completed in one field mobilization, if possible. Contingencies are included as part of the investigation to address possible anticipated conditions that may trigger the need for additional sample collection and analysis, or for the construction of additional on-site monitoring wells. If data suggest that radionuclides may be present in soil or groundwater off-site at levels

that exceed the established background levels, then a recommendation will be prepared and submitted to the USEPA regarding the need for a second phase of investigation.

31. Section 5.2.3, Page 5-7

a. The text states that supplement investigations (Phase II) may be proposed if perched groundwater and/or significant volumes of leachate are discovered, additional shallow monitoring wells and/or lysimeters may be installed. This task should be done as a part of Phase I and a contingency describing the procedures should be provided.

Response: The portion of the text referring to perched water and leachate sampling in this section has been removed. Sampling of perched water and leachate seeps will be performed as part of the proposed Phase I investigation. Please refer to the response to comment #29a.

b. The text should provide the approximate timeframe the Phase II would be carried out. Are the Phase II activities going to be carried out while in the field for Phase I or will it be a entirely different field event. Some of the Phase II tasks which may be necessary could be gathered during the same field event if a contingency was defined.

Response: If a Phase II investigation is warranted, then it will be performed as a separate field mobilization. Contingencies can and have been included in this revised work plan to minimize the potential for a Phase II investigation. The presence of radioactive contaminants off-site or incomplete characterization of Areas 1 and 2 will most-likely trigger a Phase II investigation. If a Phase II investigation is required, then an interim investigation report will be prepared and submitted. A work plan addressing the additional proposed work, and a Sampling and Analysis Plan will also be prepared.

32. Section 5.2.4, Page 5-7

It is the responsibility of MH to define the deep borings located in biased locations or any other sampling locations. It is not the EPA's responsibility to determine sampling locations. EPA is responsible for reviewing and approving MH's proposed sampling locations.

Response: Section 5.2.4 has been eliminated from the text as it essentially duplicates the text presented in section 5.2.1.4. As stated in our response to comment #29, biased sample locations within Areas 1 and 2 are based on review of historical aerial photographs and previous investigation data, and will also include the radiological "hot spots" as identified by the planned overland gamma survey.

33. Section 5.3, Page 5-7

The purpose of preliminary remedial action objectives and goals development during the scoping of the RI/FS is to assist in identifying preliminary remedial action alternatives and RI data requirements. The preliminary remedial action objectives are aimed at protecting human health and the environment and should specify: 1) the contaminant(s) of concern; 2) the exposure rate(s) and receptor(s); and 3) an acceptable contaminant level or range of contaminant levels for each exposure route. The workplan only identifies general remedial action objectives. Preliminary remedial action goals should be developed with the preliminary ARARs and exposure assessment. A more detailed list of chemical concentrations should be generated during development of the DQOs.

Response: Contaminants of concern, exposure rates, and receptors have been identified for the purposes of calculating initial preliminary remediation goals (PRGs) where chemical-specific ARARs are not available. Discussion of the development and presentation of PRGs and DQOs has been added to section 5.3 of the work plan text.

34. Table 5-1

The comment at the bottom of the table states, "The focus of this investigation in the nature and occurrence of radionuclides. The nature and occurrence of other contaminants will be examined to determine the potential for mixed waste conditions and the potential impact on selection of a remedy." The purpose of this RI/FS is to serve as the mechanism for collecting data to characterize site conditions; determine the nature of the waste; assess risk to human health and the environment; and development, screening, and detailed evaluation of alternative remedial actions. The RI/FS is not limited to the nature and occurrence of radionuclides.

Response: The table footnote has been removed.

35. Section 6.3, Page 6-3

a. Sediment samples are to be collected based on surface water flow patterns at Areas 1 & 2. The flow patterns should have been researched prior to the preparation of the WP and definitive sites identified for sampling.

Response: Figure 3-17 in section 3.3.2.2 of the revised work plan is a map of the property showing the drainage pattern and the direction of surface water runoff from Areas 1 and 2. This figure provides the preliminary basis for identifying planned rainwater run-off and drainage sediment sample locations. Sample locations will be verified by site reconnaissance. If the site reconnaissance indicates additional locations where rainwater accumulates and flows off-site, then these additional areas will also be considered for possible sampling and analysis. A map showing planned rainwater run-off and sediment sample locations is presented in the revised work plan. We are currently proposing two sampling locations in the vicinity of Area 1, and four within the vicinity of Area 2.

b. The text does not identify the chemical analyses to be obtained from surface water samples. Please expand the text.

Response: Rainwater run-off samples will be analyzed for the complete suite of chemicals of concern, except priority pollutant metals. Sediment samples will include all of the chemicals of concern, except the VOCs (EPA Method 8240 compounds).

c. Area 1 should also be examined for the presence of leachate seeps. If seeps are identified they should be sampled and analyzed.

Response: The slope faces (berms) which bound Areas 1 and 2 will be examined for the presence of seeps on a weekly basis during the time the field investigation is occurring. All seeps which are identified will be sampled. Sampling may include the installation of lysimeters. Leachate samples will be analyzed for the complete suite of chemicals of concern. If a sufficient quantify of liquid cannot be obtained, then a sample of the saturated soil will be analyzed for those chemicals of concern which could not be analyzed from the liquid sample.

d. The text states, "It is anticipated that two samples of leachate seeps may be collected". What if more than two seeps are identified in both Areas 1 and 2?

Response: All seeps identified within Areas 1 and 2 will be sampled and analyzed.

36. Section 6.4

a. There is no discussion in the WP or FSP as to why locations for borings are to be determined randomly. The lack of discussion implies that a definitive strategy has not been determined. Specific boring locations could better define geologic/hydrogeologic conditions, infill areas where basic information is lacking, explore continuity of subsurface barriers to contaminant migration, or define lateral continuity of known waste disposal source areas. An explanation should be provided as to why statistical methods to randomly identify sampling locations is necessary.

Response: Biased borings will be drilled in areas of concern as identified from review of aerial photographs, previous investigation findings, and site reconnaissance. Additional borings will be located using a stratified random sampling scheme that will result in the characterization of all areas of the potentially heterogeneous fill.

b. It is not clear why landfill gas sampling, in addition to the borehole monitoring activities identified in SAP during boring advancement, has not been proposed. Landfill gas sample analysis can help determine whether volatile organic compounds in landfill gas act as a source of contamination to groundwater. In addition, landfill gas analysis is needed for a complete site health and safety evaluation (specifically air toxics and explosives) and for a comprehensive human health assessment. According to our meeting on August 19, 1993, the text would be expanded to include a contingency plan to sample landfill gas in the event field

monitoring indicates soil gas contamination. The DQOs should discuss the intended use of the prescreening data.

Response: A landfill gas investigation is included as a contingency in the revised work plan and is described in the SAP. The DQOs identify the initial landfill gas investigation objectives as meeting health and safety and site characterization data needs.

37. Section 6.4.1, Page 6-7

The text states "Biased locations have been selected by USEPA based on Site characteristics and locations of alleged liquid waste disposal". EPA suggested locations as related to specific data gaps identified based on our review of past investigations and aerial photos. The locations are not only based on alleged liquid waste as the text states. EPA presented these locations to stress the importance of aerial reviews and review of previous data. We requested MH to review the data and aerials in order for them to identify biased sampling locations based on their scoping activities. It is the responsibility of MH to present the sampling locations for EPA review and approval. The text should be revised and MH should identify the bias sampling locations or verify EPA's suggested locations based on their review of the aerials and data from previous investigations.

Response: McLaren/Hart has reviewed historic aerial photographs of the Site, and the proposed biased soil sampling locations are based on our interpretation of the photographs and previous investigation findings. Based on our interpretation of the data, the number of biased sampling locations in the revised work plan is reduced from that presented in the previous draft. The number of biased sampling locations may potentially increase after the planned overland gamma survey is completed.

As an additional note, the un-biased sampling locations will not be entirely random as stated in the previous work plan. An alternate sampling scheme is proposed which will satisfy the need to randomly sample for statistical purposes, yet account for the heterogeneity of the landfill. The alternate scheme is referred to as stratified random sampling and involves super-imposing a grid over Areas 1 and 2. The number of cells defined by each of these grids will correspond to the number of soil borings scheduled to be drilled in each area. Soil sample locations within each defined grid cell will then be randomly located. A figure showing tentative soil boring locations based on stratified random sampling is included in the plan. This figure may be modified after completion of the planned overland radiological survey. Prior to the initiation of the soil boring program, planned soil boring locations will be presented to the USEPA and the respondent parties for review and approval.

38. Section 6.4.1, Page 6-7, third paragraph; Page 6-11, third paragraph

This paragraph on page 6-7 states that the locations of five proposed biased soil borings are indicated in Figure 6-1. The third paragraph on page 6-11 states that the locations of eight proposed biased soil borings are indicated in Figure 6-1. The text on pages 6-7 and 6-11 should reference Figure 6-2.

Response: The referenced paragraphs and Figures 6-1 and 6-2 have been revised. We are currently planning four biased boring locations in Area 1 and seven biased boring locations in Area 2.

39. Section 6.4.1, Page 6-7, third paragraph; Page 6-11, third paragraph

The text states, "The baseline level is typically considered to be approximately two times the observed background fluctuations". How will background be determined?

Response: The referenced text has been eliminated from the revised work plan. Please see Section 6 of the work plan for a discussion on our approach for assessing background conditions.

40. Section 6.4.2, Page 6-13, fourth paragraph

This paragraph states that the location of ten additional surface soil samples will be based on "observed surface indications of potential elevated concentrations of nonradiochemical contaminants." What are these "surface indications" that will be used to determine locations of non-radiochemical contaminants? Area 1 is mostly vegetated while Area 2 is largely unvegetated. Will the same "surface indications" be used for both areas? Please clarify.

Response: The text in the referenced paragraph has been revised to more clearly define the criteria for locating biased surface sample locations. The criteria defined is applicable to both Areas 1 and 2. The revised text is as follows:

"The locations for these samples will be based upon visual observations (surface staining, multi-colored soil, an unexplained damp or wet area, distressed vegetation, evaporite chemical precipitate or crust on soil, etc.) olfactory indications, and OVA and LEL/O_2 monitoring data.

41. Section 6.5, Page 6-15, sixth paragraph

This paragraph states that the tentative monitoring well locations are indicated in Figure 6-2. Figure 6-2 is a figure indicating the location of biased soil boring locations. The text should reference Figure 6-1. For clarity, Figures 6-1 and 6-2 should be renumbered and their respective positions within the document switched (see above comments).

Response: The revised text references the correct figures for planned soil borings and monitoring wells. The figure numbers have been changed in response to your suggestion.

42. Figure 6-2

a. The approximate area of the grid location to be surveyed should be shown on Figure 6-2.

Response: A figure identifying the location of the planned overland gamma survey has been prepared and is included in the revised work plan.

b. Approximate surface water and sediment sampling locations should be identified on Figure 6-2 or a separate figure should be provided with such locations.

Response: A separate figure has been prepared to identify tentative locations for the planned erosional sediment samples. The figure showing planned monitoring well locations has been revised to include surface water sampling locations and the locations of the planned staff gages.

43. Section 6.6

Grain-size analysis is a method of determining permeability of the silty clay. If encountered, a silty clay sample could be collected as a core and delivered to a geotechnical testing laboratory for permeameter analysis. This test method is more reliable than grain-size extrapolation.

Response: If perched water is encountered during the drilling of the soil borings, then the effectiveness of the fine grained clayey/silty unit which underlies the perched water to act as a groundwater barrier may be evaluated by determining the permeability of that unit. Geotechnical permeability testing of a relatively undisturbed sample will be the recommended method to determine the permeability. If it is not possible to obtain an undisturbed sample, then permeability will be determined by an alternate method which involves grain size and hydrometer analyses to estimate the permeability.

44. Section 6.9

Sampling and associated geotechnical testing to support the berm stability studies should be performed and discussed in the SAP.

Response: Field work to be performed as part of the evaluation of the slope (berm) which bounds Area 2 will include: collection of soil samples using a hand-held sampler from the face of the slope, and also from the top of the landfill using a large diameter drilling rig equipped with a drive sampler; field mapping to profile the slope at several locations; and visual evaluation of any portions of the slope which have been exposed due to failures or erosional scour. Groundwater data from a nearby well will also be obtained.

Soil samples will be analyzed for moisture/density, and a direct shear test will be performed to determine shear strength characteristics of the soil cover and the soils contained within the landfill. Building materials and miscellaneous debris present within the landfill may prevent the collection of relatively undisturbed soil samples; therefore, the samples may need to be screened in the laboratory and remolded to the field density prior to testing.

A shear test and a consolidation test will also be performed on an undisturbed soil sample from the alluvium beneath the landfill. If obstructions within the landfill prevent drilling to the desired depth, then an undisturbed sample should be collected at the toe of the slope.

Using field and laboratory data, the stability of the soil cover and the landfill mass can be determined graphically, or using one of the various computer software programs available.

45. Section 6.8, Page 6-18, third paragraph

This paragraph identifies the existing monitoring wells to be sampled. Of the ten existing wells which will be sampled, none lend themselves as a suitable background well. A suitable background well has yet to be identified.

Response: Determining background conditions is difficult for this site and may not be possible using data from only one well. Issues which will impact determination of background conditions include the following:

- The historic edge of the Missouri River alluvial valley is located within the southern portion of Area 1. Sediments north of this contact are underlain by river alluvium; sediments south of this contact are underlain by loess and shallow limestone bedrock. Water quality data from a well placed upgradient, and off-site (south of the Site) will be representative of background conditions in the loess and limestone, and not the alluvium which underlies Areas 1 and 2.

- A treatment retention pond is located southwest and south of Areas 1 and 2, respectively. Smaller surface water bodies are also located north and east of this retention pond. Water elevation data for monitoring wells in the vicinity of the pond and smaller surface water bodies suggest that leakage from one or more of these surface water features may be occurring and act as a source(s) of groundwater recharge. If groundwater recharge is occurring, then water quality data from a well located downgradient of these features may not be representative of background conditions. A well placed upgradient of these areas will be representative of the loess and limestone, and not the alluvium.

- Groundwater flow beneath the Site is believed to be impacted by the former quarry which is located upgradient of Areas 1 and 2 and acting as a groundwater obstruction, and the surface water bodies which bound the West Lake property on the east and west and may be sources of groundwater mounding and recharge. If the perimeter surface water bodies are contributing to groundwater, then water quality data from the existing and planned monitoring wells along the perimeter of Areas 1 and 2 may not be representative of background conditions.

- One alluvial aquifer exists beneath site. Groundwater recharge occurs from the loess and shallow limestone south of the Site, and also from surface water infiltration. It is not known whether vertical differences in water quality in the alluvium naturally occur in response to the various sources of groundwater recharge.

As a result of the above concerns, there is insufficient data at this time to determine whether water quality data from one well will be indicative of background conditions. Statistical analysis of data from several wells may be a reasonable method to determine background conditions. Confirmation of groundwater flow direction will be critical for selecting the wells that could be included in a statistical analysis. Groundwater wells which were not previously identified, but should be considered as part of the background determination are MW-105, MW-106, and D-95.

46. Section 7.2, Tables 7-1 through 7-3 and 7-5

The Tables which include Potential Federal Location-Specific ARARs, Federal Action-Specific ARARs, Federal Chemical-Specific ARARs, and Preliminary Identification of Possible Response Actions and Remedial Technologies do not list any NRC regulations. Potentially applicable NRC regulations include 10 CFR Parts 20, 40, 61, and 71.

Response: NRC regulations and guidance have been included in Table 7-4 as TBCs (This is consistent with telephone discussions with Diana Newman of EPA.)

47. Section 7.2, Table 7-4

a. Table 7-4 does not include NRC guidance as the Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites (57 FR 13389) or Manual for Conducting Radiological Surveys in Support of License Termination (NUREG\CR-5849).

Response: NRC guidance found in the Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites and Manual for Conducting Radiological Surveys in Support of License Termination have been added to Table 7-4.

b. Equipment and non-disposable PPE used in characterizing the radiologically contaminated areas will need to be surface decontaminated to levels described in NRC Regulatory Guide 1.86 (cited in 57 FR 13389) before they can be released for unrestricted use.

Response: NRC Regulatory Guide 1.86 has been added to Table 7-4.

48. Section 7.2.4, Page 7-29, second paragraph

This paragraph states that federal and state criteria, advisories and guidance TBCs are provided in Table 7-4. However, only federal TBCs are presented in the referenced table. Missouri's proposed Any-Use-Soil-Levels (ASLs) should be considered as TBCs.

Response: Missouri's proposed Any-Use-Soil Levels for Residential Settings (19CSR20-9.020) was withdrawn by the State on November 2, 1992 (17 MO. Reg. 1590). As a result, we have not identified the ASLs as a TBC.

49. Table 7-3, Pages 1 of 10 through 10 of 10

a. Table 7-3 should be renumbered in the same manner as Table 7-2A/B to designate and distinguish federal versus state chemical-specific ARARs.

Response: Table 7-3 has been renumbered in the same manner as Table 7-2.

b. Table 7-3 only lists chemical-specific ARARs for metals and radionuclides. The VOCs, SVOCs, pesticides, TPHs, PCBs, and cyanide. The MCL should be re-evaluated. The MCL of 50 ug/l is incorrect. The NRC ARARs should be provided for radionuclides.

Response: Chemical-specific ARARs have been included for VOCs, SVOCs, pesticides, TPH, and cyanide as appropriate. The MCL for lead has been changed to 15 ug/l.

50. Section 8.0

It is not clear why the previous investigation reports were not evaluated and assessed to determine technical errors, shortcomings and data gaps. The text states, "It is assumed that no errors exist in the data from previous investigations presented in this Work Plan that cannot be determined by a normal evaluation and analysis of the available information." What is a "normal evaluation". Evaluation and assessment of existing data is part of the scoping phase of the RI/FS and must be completed prior to RI/FS workplan preparation. It would seem impossible to adequately scope an investigation without properly identifying the data gaps. Several inconsistencies and technical shortcomings have been identified in the previous reports. These shortcomings and data gaps must be addressed during the RI/FS.

Response: Limitations of the data evaluation have been more clearly stated in Section 8.0.

51. Section 10.4.3, Page 10-8

The surface water within the site (i.e, surface water north of Area 2) will also be critical in developing an understanding of the contaminant transport. This data should also be considered.

Response: The text of this section has been revised to indicate the relevance of surface water data analysis, in that surface water stages, characteristics and flow patterns will be evaluated. The text now indicates that the surface water at the site will be studied to determine run-off and flow patterns, the potential for erosion, and other characteristics that could impact transport of contaminants across or off the site. Additionally, surface water will be evaluated to determine its potential for groundwater recharge and localized groundwater mounding.

52. Section 10.4.4, Page 10-9, last paragraph

This paragraph states that a map showing potential receptors, if they exist, will be prepared based on regional information. Every individual working on the site is a potential receptor. The phrase "if they exist" should be deleted from the text. There are other operations near the site (i.e., asphalt company, landfill operations, concrete plant etc.) which have workers who are all potential receptors.

Response: The phrase "if they exist" has been deleted from the text.

APPENDIX A - Site Safety and Health Plan

53. Section 2.4, Page 2-8, Tasks 5 and 6

The information contained in these bullets does not agree with information contained in the draft final work plan regarding number of monitoring wells to be installed or number of groundwater samples to be collected. It is not appropriate to define the number of samples to be collected in the SSHP. We suggest Section 2.4 be changed to eliminate the number of samples proposed. The SSHP should be a separate document and would not change unless site conditions regarding health and safety change. EPA does not approve the SSHP and currently the SSHP is submitted as an Appendix to the WP. We suggest the SSHP be submitted as a separate document.

Response: Section 2.4 of the SSHP has been revised to remove reference to the number of samples to be collected. The SSHP will be submitted as a separate document rather than being submitted as an appendix to the work plan.

APPENDIX B - Sampling and Analysis Plan

54. Land Surveys:

What are data quality expectations for locating well elevations, surface sample sites, radiological survey-grid positioning, etc.

Response: All sampling locations, radiological survey points, leachate seeps, and staff gage locations will be surveyed by a licensed surveyor and referenced to an existing on-site monument located at the northeast corner of the weigh station, along the St. Charles Rock Road entrance. Each location will be surveyed for elevation to an accuracy of 0.01

feet, and northing and easting coordinates to the nearest 0.1 feet. Surveying of monitoring wells will include the elevation of the ground surface, top of casing (north side of casing), and the top of the protective casing. The location and elevation of all existing monitoring wells will be re-surveyed. Survey data will be obtained in text format, and also a format suitable for inclusion in the site database.

55. Well-92

Downhole geophysical techniques should be employed to determine well construction details (i.e. position/depth of screen and total depth of well.

Response: We do not recommend the use of downhole geophysics to evaluate well design and construction. It is our experience that geophysical tools may not be effective in discerning the screened interval and the depth at which the bottom of the sanitary seal was placed. Variables such as formation lithology, boring diameter (as impacted by caving during drilling/construction), well construction material differences, changes in well casing diameter, etc. can impact the geophysical signature and lead to inconclusive findings. Based on review of previous hydrologic data, groundwater data show a general downward gradient with the wells completed at the greatest depths having the lowest elevations. The work plan has been revised to indicate that the bottom of the well will be determined using a weight attached to the water level sounder cable. Once the depth of the well is verified, the well will be classified as a shallow, intermediate depth, or deep alluvial well.

56. Wells D-93 and D-94

Data collected from these wells should be considered questionable for groundwater quality or water level determinations because these wells were not completed properly (no gravel sand in annulus). Data collected from these wells can be used for meeting data quality objectives that do not rely on well completion technique (i.e. stratigraphic information). Quality and elevation data should be compared to data collected from nearby wells for conformance with regional trends before inclusion in remedial investigation reports.

Response: Water elevation data for monitoring wells D-93 and D-94 have been compared with elevation data for surrounding wells and the elevations are found to be consistent with wells which were completed at similar depths and screen intervals. We plan on using these wells as part of the planned monitoring program.

We recognize that because of well construction, water quality data from these wells may be considered suspect, and should not be used to make definitive statements regarding the presence or absence of chemicals within the depth interval over which they are completed. However, water quality data from these wells can be used to support an interpretation.

57. Wells/borings of the EC series

Wells at Ford EC locations (D-95, EC-8, EC-9, and EC-12) do not appear on site maps.

Response: Monitoring well D-95, EC-8, and EC-9 have been included on the appropriate groundwater maps in the revised work plan.

58. Soil Borings

a. If fluid is encountered above the silty clay layer deep boring, a switch in drilling technology should be considered (to casing hammer drive) to eliminate the possibility of cross-contamination across the aquitard through the borehole.

Response: If perched groundwater is encountered within the landfill or at the base of the landfill, drilling will stop and an attempt will be made to collect a water quality sample using a hydropunch. At the time the water is encountered, the USEPA and the Respondent parties will be notified and the need to consider a change in drilling techniques and procedures will be discussed. A contingency for drilling soil borings with a hollow-stem auger is included in the revised work plan.

b. If perched water is encountered, it should be sampled. The SAP does not address this contingency

Response: As stated above, if perched water is encountered, then an attempt will be made to collect a sample using a hydropunch. Perched water samples will be analyzed for the complete suite of chemicals of concern, if a sufficient quantity of water can be collected. If the quantity of water collected is insufficient, then the USEPA will be informed of the condition, and the analyses to be performed will be jointly determined.

c. Even though this Phase of the investigation is directed toward characterization of radiological contamination, the nonradiological constituents in the alluvial aquifer should be better addressed.

Response: The revised work plan states that all soil borings are scheduled to be terminated within the alluvium which underlies the landfill. Continuation of a boring beyond the upper portion of this contact will occur if 1) it is questionable whether the underlying alluvium is undisturbed and possibly not representative of existing in-place conditions, and 2) visual, olfactory, or field monitoring data suggest that potentially hazardous chemicals may exist within the underlying alluvium and that further soil sampling is warranted to obtain samples to verify the vertical depth of potential impact (Please refer to the response to comment #70 for visual and monitoring data which may trigger contingency soil sampling and analysis). Collection and analysis of soil samples below the groundwater surface within the alluvial aquifer is not planned at this time. If conditions warrant as stated above, then sampling of these materials may potentially occur.

If contingency soil sampling and analyses are performed, then the soil sample collected at the depth of concern will be analyzed for the complete suite of chemicals of concern; however, conditions that trigger the collection of a sample may also be used as a basis for limiting the number of analyses to be performed. The USEPA will be consulted and confirmation will be obtained prior to any reduction in the types of analyses to be performed. Samples which may be analyzed below this depth will be analyzed for only those constituents which were detected at concentrations above the defined background levels.

d. Chemical analyses are to be performed on samples to characterize fill and refuse deposits. However, characterization of fill and refuse will be tricky due to the diversity of materials that will be encountered. The sampling strategy should be described in more detail, possibly in the DQO section. The strategy should discuss the reason for characterizing the refuse/fill and proceed to explain the methodology for:

- Recovering a representative sample,
- Preparing a homogeneous sample aliquot, and
- Identifying the types of chemical analyses that will fill the DQO requirements.

Response: As described in the revised work plan; the planned sampling strategy is to determine the possible presence, and characterize the distribution of any hazardous chemicals detected beneath the Site. Borings will be located at radiological "hot spots", at locations of concern based on review of aerial photographs, and at random locations. Selection of soil samples for analysis will be based on a downhole radiological logging, near the base of the landfill debris, and at any location that visual, olfactory, or monitoring data indicate the possible presence of hazardous compounds. Background samples will be collected and analyzed to determine impact of past activities on soil vapor, soil, and groundwater beneath the Site.

The refuse/fill will not be characterized, other than in general terms, e.g., municipal waste, construction debris, and other distinguishing materials. The purpose of the sampling plan is to characterize the hazardous compounds that may be present, and as such, the objective is to obtain biased samples having the highest likelihood of containing contaminants rather than "representative" samples. Samples collected from each boring will be biased and representative of the radiological conditions, the lower portion of the landfill and underling alluvium, and any other area that appears to be a concern based on visual observations and monitoring data.

All soil samples have been designated as having an "Analytic Level III" data objective (barring problems that may arise from analytic interference associated with any heavily contaminated samples) to support site characterization and risk assessment. Visual observations and field survey monitoring data will be used to assist in the collection of soil samples and will be "Analytic Level I".

e. The text states that soil borings will be drilled to depths of 5 feet below the refuse. How will the term "refuse" be defined in the field investigation (what are the diagnostic characteristics of refuse)?

Response: The revised work plan is based on terminating all borings within undisturbed alluvium which underlies the refuse. The proposed drilling method using a large diameter auger will allow visual evaluation of all drill cuttings. Evidence of undisturbed conditions include: vegetation, roots, blocky soil structure, sedimentary stratification, etc. Based on review of aerial photographs it is anticipated that a layer of limestone rock debris from quarry operations may be present beneath the landfill deposits along the contact with the underlying native alluvium.

The type of refuse to be encountered during drilling of the landfill is not known, but will most-likely consist of construction debris and municipal waste.

f. What criteria will be used to determine when clean soil has been encountered and when the base of the refuse has been encountered? Clean-looking material could be foundation soils beneath the refuse or a stratified layer within the refuse fill. "Clean soil" should be identified on the basis of specific field parameters or down-hole tests.

Response: The term "clean soil" is not used in the revised work plan. Boring termination will be based on encountering undisturbed alluvium as indicated in the above response.

g. How will the base of the landfill be identified if the thickness of refuse is unknown? One suggestion would be to bore until 3 consecutive "spoons" of clean soil are recovered and then submit the first for chemical analyses as representative of landfill foundation soils.

Response: Please see the above comments. It is anticipated that visual observations will be sufficient to terminate most borings within 3 to 5 feet of encountering the contact with the underlying undisturbed alluvium.

59. Water Level Measurements

a. One of the more serious deficiencies of the West Lake Landfill workplan is the conceptual model of the groundwater processes. The description of local flow relationships is based on average piezometric conditions; previous comments have stressed that the use of average values is unacceptable for developing a model of groundwater flow.

Response: As stated in the response to comment #22 groundwater data collected on March 30 and August 8, 1985, have been contoured and are included in the revised work plan. Our interpretation of groundwater flow conditions beneath the Site is based in part on the two contour maps. The groundwater contour map which was included in the September 2, 1993 work plan (based on averaged groundwater elevations) has been

eliminated from the report. Our conceptual groundwater model is not based on this drawing, nor averaged groundwater elevation data.

b. Site-wide, static groundwater conditions can only be described by using data that is collected within a short time period by the same team of investigators. Numerous inconsistencies in the groundwater model were found which can only be resolved using accurate and current water level information. For example, a large cross-section of the wells were measured during August 1985. A groundwater elevation contour map constructed from this data shows the presence of anomalous sinks and mounds that are difficult to resolve with the conceptual model.

Response: As stated above in comment #59a., we have developed our groundwater conceptual model based on interpretation of groundwater data collected on specific dates and not averaged data.

c. All wells should be measured before RI activities disturb existing hydrogeologic conditions. The costs associated with this simple activity are not excessive. Competent professionals could measure the water levels in the existing wells within 1-2 days, using modern transducers and dataloggers. This activity should be repeated after all new wells are completed and stabilized.

The most practical approach would be to collect water level measurements during the field visit to conduct slug tests. Water levels have to be determined for the slug test so that the slug can be carefully introduced into the well. The wells that are not slug tested can be measured for water levels before slug testing commences.

Response: One of the initial tasks to be performed will be to evaluate the condition of each existing groundwater monitoring well soon after mobilization to the field. As part of this task groundwater levels will be measured in each well, and the bottom of the well measured. Each well will then be re-developed to remove sediment which may have accumulated in the bottom of the well, and to ensure that the purged water is non-turbid (< 100 Nephelometric Turbidity Units [NTUs]). Water levels in the wells will be re-measured approximately one week after development to verify previous data and to evaluate possible changes in water levels which may have occurred as a result of the development. Slug tests will not be performed until after all planned monitoring wells have been constructed, developed, monitored, and sampled.

60. Groundwater Sampling

a. Groundwater wells, I-67 and MW-F3, exhibited high radiological activity in 1990 (Figure 3-16). These wells should be re-sampled to confirm the earlier analyses. In addition, existing wells further removed from the landfill and downgradient of the high activity wells should be sampled to establish the lateral extent of contamination. Some attempt should be made to compare these values to background conditions in limiting the lateral extent of contamination.

Response: I-67 has been included as an additional well to be sampled; however, the physical condition of this well and any other existing wells must be verified as an initial step, and the wells must be re-developed prior to sampling. Some existing wells may be damaged and unsuitable for sampling. The condition of I-67 and MW-F3 is not known at this time.

b. The use of PVC has questionable advantages. During the reconnaissance phase of investigation, PVC is cost effective. However, if organic contaminants are discovered, it is not likely that the PVC wells can provide long-term defensible samples and stainless steel wells may be required. As long as radionuclides/metals are the primary contaminants, the use of PVC will be acceptable.

Response: During the implementation of the work plan the soil borings will be drilled and soil sampled prior to the construction of the monitoring wells. Soil analytical data collected from the borings will provide a basis for recommending a possible change in well construction materials. Based on review of previous analytical data, organic contaminants have only been detected sporadically and at trace to low concentrations. Monitoring wells are currently scheduled to be constructed using PVC casing and screen materials.

c. Information regarding the joining of the PVC well casing material must be provided. Will threaded joints be used?

If not, how will the casing be assembled without introducing organic glue into the monitoring system?

Response: Wells constructed of PVC will use threaded pipe and screens. No glue will be used at any time.

d. The SAP indicates that when penetrating landfill material or installing a bedrock well, a 6 (or 8) inch well casing may be grouted in place and a 6 (or 8) inch borehole drilled below to accommodate a 2 (or 4) inch monitoring well. The 6 (or 8) inch (OD) casing will not provide sufficient clearance for the drill bit. Even if the bit could fit into the casing, bends and irregularities in the casing would cause "hang-up" areas. It is recommended that the upper casing be stepped using 8 (or 10) inch diameter material to facilitate the installation of the monitoring

Response: The revised work plan is based on constructing monitoring wells in the alluvium at three different depth intervals using a hollow-stem auger drill rig. A contingency for construction of bedrock wells is also provided. For those wells located within areas underlain by landfill deposits, a large diameter auger drill rig will be used to penetrate the landfill. The diameter of this boring will vary from 12 to 36 inches depending on the presence of obstructions which may be encountered during the drilling of the borings. The auger borings will be backfilled with imported clayey, fine grain soil after completion of the drilling, and prior to the drilling of the monitoring wells.

Drilling of the monitoring wells with a hollow-stem auger through the clayey backfill should eliminate the need to install casing in most instances. If casing is required, then it will be low carbon steel casing of suitable diameter to accommodate the drilling equipment to be used to drill the monitoring well. If the contingency bedrock wells are constructed, then low carbon steel casing will be installed and extend from the ground surface through the alluvium and upper portion of the limestone bedrock.

61. Slug Tests

a. The text indicates that different sized "slugs" will be used to test the 2 inch and 4 inch wells. A slug that is used to induce a meaningful head change in a 2 inch well will not induce a dimensionally similar displacement in a 4 inch well. The most practical solution is to use slugs with different outside radii that can create a 2-3 foot (minimum) head change. The desired head change should be based on aquifer properties and expected response to the introduction of the slug.

Response: The text has been revised to state that an appropriately sized slug will be used to perform the slug tests. The slug diameter and length will vary depending on whether testing is performed on a 2-inch or 4-diameter well, and whether testing is to be performed on a well completed within the alluvium, which is expected to have a relatively high transmissivity, or bedrock, which is expected to have a significantly lower transmissivity. The length of the slug should be sufficient to create a minimum of 2 to 3 feet elevation change in groundwater level.

b. The data obtained from the slug tests would be more defensible if the tests are conducted before sampling. Well purging may effect aquifer response to the slug test; these effects cannot be quantified. Unnecessary doubt as to the representativeness of the test could be introduced if anomalous results are observed.

Response: Slug tests will not be performed during the time the monitoring wells are being sampled. As stated in our response to comment #59c, slug tests will be performed after all planned monitoring wells have been drilled and constructed.

c. The text does not include a statement that the slugs will be decontaminated. As slugs are not disposable or dedicated tools, they will have to be reused which could introduce cross-contamination between wells (and aquifers).

Response: An equipment decontamination requirement has been added to Section 3.6.4.

62. Geotechnical Testing

a. The SAP does not discuss the geotechnical testing that will be performed on the silty clay, if encountered. How many test samples will be collected and what are the criteria by which the test samples will be selected.

Response: Geotechnical testing of the clay, if performed will be limited to permeability testing. Please refer to the comment #43 for a discussion on the tests to be performed.

The decision to test a sample will depend on the thickness of the clay unit and if perched water is encountered on top of the clay. If the clay layer is less than 5 feet thick, then no sampling and testing will be performed. It is our experience that silt and clay units with a thickness of less than 5 feet may not be an effective barrier, especially in this geologic environment where sandy interbeds may be present.

b. The workplan discusses collection of silty-clay and grain-size analysis for determination of permeability. Grain-size analysis is not as good as a laboratory permeameter test.

Response: Laboratory permeability tests are the preferred testing method. Estimating permeability by performing grain size analyses and hydrometer tests will be only performed if the soil samples are disturbed and unsuitable for testing. Please see comment #43 for further discussion.

63. Section 2.0, Page 2-2

Leachate samples must be analyzed for selected radionuclides, priority pollutant organics, and metals and cyanide. Nitrite should be analyzed in addition to the indicator parameters listed on page 2-2.

Response: Nitrite has been added to the list of leachate indicator parameters.

64. Section 3.2, Page 3-1, third paragraph

The approximate locations of the grid pattern should be presented on a figure within the FSP for Area 1 and 2. The grid location should be based on the data from previous investigations.

Response: A figure showing the location of the proposed overland survey is included in the revised work plan. The proposed survey grid extends outward from the defined boundaries for Areas 1 and 2, and additionally includes the slope (berm) of Area 2.

65. Section 3.2, Page 3-1, fourth paragraph

This paragraph states that "A gamma survey instrument will be used to determine microRoentgen readings throughout the areas of investigation. Gamma measurements at 1 meter will be made using a microRoentgen survey instrument (e.g., NAI count rate meter)." A count rate meter instrument reading is not a measure of exposure rate. An ion chamber instrument should be used to determine microRoentgen readings on Site. The chamber should be open to the atmosphere to allow the fill gas to be ambient air. An ion chamber instrument open to the atmosphere is the only true measurement of exposure in air.

Response: We agree that a count rate meter does not directly measure exposure rate. However, a portable NaI detector is better suited for rapid measurement of low level environmental radiation; providing nearly instantaneous measurement results (ion chambers have to be left in place for 20 to 60 minutes). Measurements from NaI detectors can be calibrated against ion chamber measurements to obtain exposure rate. The text has been revised as follows to reflect the planned calibration and sampling procedure:

Known or suspected contaminated areas at the Site (including the Area 2 berm) will be surveyed using a hand held or vehicle-mounted sodium-iodide, thallium-activated (NaI (T)) gamma-ray survey instrument to determine radiation levels in units of counts per minute (cpm). The NaI detector will be cross-calibrated with an integrating, pressurized ionization chamber (ion chamber) at least once a day within the area to be surveyed. This cross-calibration will permit the translation of the detector measurements in cpm to gamma exposure rates in units of micro-R per hour (μR/hr) in air. Cross-calibration measurements will be performed daily at up to three known "hot spots" by taking co-located NaI detector and ion chamber reading at one meter above the hot spot for a period of time sufficient to obtain a stable reading (20 to 60 minutes for the ion chamber). Such multiple point field calibrations are desirable since the NaI detector is much more energy dependent than the ion chamber. The derived conversion factor accounts for the differential energy of the gamma photons that penetrate the ground and those from the Cs-137 calibration source. Since the depth and isotopic distribution of the contamination (and therefore the energy of the penetrating photons) may vary across the site, a mean conversion factor is derived from measurements at several locations.

66. Section 3.3, Page 3-2, first paragraph

The text states "Prior to drilling, McLaren/Hart will request that all maps and other information regarding the location of buried utilities and pipelines on the Site and properties adjacent Radiological Areas 1 and 2 be available for review". The utility maps and a site reconnaissance should have been performed prior to the development of the workplan and SAP. Drilling into debris (i.e., drums, buried liquids, etc.) is also of potential concern. McLaren/Hart should consider the use of a geophysical survey to identify potential subsurface areas.

Response: Underground utility companies have been contacted and the maps provided do not indicate the presence of underground utilities beneath Areas 1 and 2. Prior to the start of the drilling, each planned boring/well location will be staked, and a geophysical survey will be conducted to identify an area within a 15 foot radius of the stake having the least possible amount of subsurface obstructions. The planned geophysical method to be used is total field magnetics.

Per McLaren/Hart health and safety requirements, a utility clearance check will be performed at all planned boring/well locations. The clearance will be performed using a RadioDetection RD400 pipe locator.

67. Section 3.3.1, Page 3-2

A figure identifying approximate soil boring locations should be presented.

Response: A figure showing the locations of the proposed biased soil sampling locations is included in the revised work plan. The figure shows the stratified sampling grid.

68. Section 3.3.1, Page 3-2, second paragraph

a. Please define "highest levels of radiation". What is the basis of comparison?

b. Please define elevated surface radiation.

c. The text states that "...the locations for these borings will be considered and determined by USEPA and the Respondent Group". The text should be revised to state that the locations for these borings will be submitted by the Respondent Group to EPA for review and approval.

Response to 68a, b, c:

The text has been revised as follows to be responsive to the three comments above:

Radiological "hot spots" are defined as areas exhibiting gamma-ray exposure rates that are a factor of two higher than the exposure rates encountered in radiologically uncontaminated areas with otherwise similar soil characteristics. Background exposure rates are the basis of comparison for defining hot spots and are expected to fall in the range of 6 to 10 uR/hr. The average background radiation exposure rate reported by the National Council for Radiation Protection for middle America is 7 uR/hr (NCRP, Report No. 94, 1987). Local background will be established by taking a measurement off-site on the open field east of the site and east of the St. Charles Rock Road entrance to the site.

It is recognized that, as a landfill, the site likely has received soils from a variety of sources and, as a result, definition of a representative background sampling location is difficult. In order to establish a representative site-specific background measurement, an attempt will be made to identify an off-site, background sampling location that has surface soils that are similar to the majority of the soils found on the Site. If sources of the soil fill can be clearly established such as any borrow areas on-site or specific uncontaminated areas of the Latty Avenue site, these sites may be proposed by the Respondants as additional background sampling sites for EPA approval.

In evaluating site measurements against background measurements and identifying "hot spots", consideration will be given to any apparent differences in soil type at the various on-site measurement locations, and the typical range of gamma-ray exposure rate values reported for regional soils. With the preceding caveat in mind, those locations indicated in the overland radiological survey as having maximum exposure rates greater than twice background, will be designated as "hot spots". In the event that there are; an excessive

number of "hot spots" identified under this criteria, or the indicated locations are not sufficiently distributed across the Site, or no hot spots are identified, then the recommended alternate locations for borings will be submitted by the Respondent Group to EPA for review and approval.

d. The details on the methodology and procedures for the overland radiological survey presented in Section 3.2 of the FSP does not provide enough information.

Response: As described in our response to comment 65, we are proposing the use of an NaI detector that is cross calibrated to an ion chamber for a gamma survey at 1 meter above the ground surface. Additional details on this sampling have been added to the text. The last version of the work plan also included sampling for beta/gamma at 1 cm above the surface to detect surface contamination. However, in the revised plan we are proposing that surface soil samples be collected and submitted for laboratory analysis at the five selected "hot spot" sampling locations, and that the field beta/gamma survey instruments not be used.

69. Section 3.3.1, Page 3-2, third paragraph

The text states "Biased locations have been selected by USEPA based on Site characteristics and locations of alleged liquid waste disposal". EPA suggested locations as related to specific data gaps identified based on our review of past investigations and aerial photos. The locations are not only based on alleged liquid waste as the text states. EPA presented these locations to stress the importance of aerial reviews and review of previous data. We requested MH to review the data and aerials in order for them to identify biased sampling locations based on their scoping activities. It is the responsibility of MH to present the sampling locations for EPA review and approval. The text should be revised and McLaren/Hart should identify the bias sampling locations or verify EPA's suggested locations based on their review of the aerials and data from previous investigations.

Response: The planned soil borings are based on McLaren/Hart review of aerial photographs and previous investigation findings. Please refer to comment #29c for a more detailed response.

70. Section 3.3.2, Page 3-3

There are no discussions regarding contingencies for additional sampling (i.e., leachate being encountered, additional chemical analysis based on soil color change, sludge material encountered, elevated VOCs detected during monitoring of soil cores, etc.). Please provide the rationale and criteria of the contingency to be used for potential additional sampling to be performed. For example, what will constitute a soil color change, sludge material, or elevated VOCs during monitoring of soil cores?

Response: Drilling and soil sampling as described in the revised work plan is based on the use of a large diameter, truck mounted auger. This type of drill rig is recommended because rock, concrete, and large metallic objects may be present in the landfill underlying Areas 1 and 2. The presence of these objects will limit the use of a small diameter hollow-stem auger, or other drilling equipment. Drilling will be initially performed using a 12-inch diameter auger bit. If obstructions are encountered, then the a larger bit will be used to advance the boring beyond the obstruction to the planned termination depth. The suggested maximum bit size is 36-inch diameter.

With the large diameter auger, drilling is accomplished using a 3-foot to 7-foot long auger bit which is attached to a telescoping kelly. Borings are generally drilled un-cased. Soil cutting are removed from the boring on the auger bit and discharged onto the ground surface. The removed soil is generally representative of the bottom two to three feet of the boring. Soil materials from the boring are continuously, visually evaluated and will be monitored for VOCs using a Foxboro organic vapor analyzer (OVA), a GasTech combustible gas indicator (lower explosive limit/oxygen meter [LEL/O_2], and radioactivity using a Geiger-Muller counter.

Each soil boring will be drilled, if possible, to the bottom of the landfill and terminated in the underlying, undisturbed native alluvium. A detailed lithologic log will be prepared during the drilling of each boring using Unified Soil Classification System nomenclature. Soil descriptions will include color, based on Munsell soil color charts; percent fines, sand, and gravel; field determined plastic characteristics of the fine fraction; grain size and grading of sand and gravel fraction; relative moisture content; and the presence of distinguishing features which may be indications of in-place or man-made deposits. In-place indications include: sedimentary structures such as bedding, vegetation and roots, blocky structure, etc. Man-made deposits can be expected to include: trashy debris and rubbish, concrete, brick, rock, especially limestone from the former quarry operations, wood and other construction materials, non-native vegetation, etc.

Soil samples for potential laboratory analyses will be collected from each boring at 5-foot intervals from the bottom of the auger drill bit. Each sample will be placed in an appropriate container, and handled in accordance with the procedures identified in Section 4 of the SAP. For each sample retained for potential laboratory analysis, a second sample will be collected and temporarily placed in a disposable, resealable plastic bag. This second sample will be used to determine field VOC headspace concentrations, the presence or absences of methane, and measurable radioactivity. These field monitoring data together with the drilling lithologic log, and the planned downhole radiological survey will provide the basis for selecting soil samples for laboratory analyses.

If during the drilling of a boring, groundwater seepage is encountered within the landfill deposits, or at the base of the landfill, then drilling will temporarily stop and an attempt will be made to obtain a water sample using a hydropunch sampler. If attempts are unsuccessful, then a representative sample of the saturated soil will be collected, and retained for laboratory analyses.

Contingency sampling will occur primarily in response to encountering perched water as indicated above, or observations during drilling which suggest the possible presence of an unknown hazardous chemical compound. Drilling observations which may trigger contingency soil sampling and analyses will be based on visual (semi-solid liquids [sludge],oily film on soil, multi-colored soil, crystalline structure, leaking drums, etc.), olfactory, or field monitoring data (e.g. significant change [10x] in OVA readings compared to other measurements in the boring).

71. Section 3.3.3, Page 3-5, first paragraph

The text states "Procedure manuals for performance of the down-hole radiological survey will be provided in the field". The equipment to be used should be defined within the FSP with a brief discussion on the equipment to be used and the details of the calibration procedures and the frequency of calibration. The manufacturers operating procedures manuals should be referenced within the FSP and submitted to EPA. The standard operating procedures to be used at the site should be provided in the FSP or presented in the appendices.

Response: The following discussion has been incorporated into the text of the work plan:

Down-hole radiological surveys will be performed using a 3/8"x3/8" sodium iodide (NaI) detector with a portable single channel analyzer (SCA). The NaI detector is attached to a cable and lowered into the boring. Measurements are recorded starting at the bottom of the boring and then moving up. The scaler to be used is a Ludlum Measurements Inc. Model 2200 or Model 2350 which can be operated in either the scaler or count rate mode. These devices are hand-held units that can be operated using an internal battery supply. The operating procedures for these units (which will be provided to EPA prior to the initiation of field work) are described in the manufacturer's operating manuals[1]. The analyzer will be set up with an energy threshold of approximately 100 keV and an open energy window. The detector is calibrated semi-annually with a Cs-137 source to verify the relationship between cpm and exposure rate (about 30 cpm/uR/hr). Calibration of the detector is performed at a licensed calibration facility.

Down-hole gamma logging will be used to identify the extent of radioactive contamination in the fill material in Areas 1 and 2. In addition, while it is currently planned to take soil samples from each boring for the purposes of radiochemical determination in the laboratory, alternate methods of determining the concentration of the radionuclides of interest using measurements taken from direct readings of the NaI detector, or gamma spectroscopy performed in the field using a germanium detector will be explored during the initial bore hole analyses. The use of such direct readings to characterize radioactive contamination would require the demonstration of a constant

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[1] Ludlum Measurements, Inc., Sweetwater, Texas. Operating Manual for the Ludlum Model 2200 Single Channel Analyzer; Operating Manual for the Ludlum Model 2350 Data Logger.

relationship between the concentration of the various radionuclides at the site (in the case of field gamma spectroscopy, only Th-230 is not a gamma emitter and would require demonstration of a constant relative concentration). If such a constant relationship is demonstrated in a number of the soil borings, EPA approval will be sought for the use of direct field readings for quantification of radionuclides in the remaining bore holes.

The process for establishing whether radionuclide concentrations are constant at the site will involve comparison of measurements obtained with the NaI detector at a given depth with the radiochemically-determined concentration of the various radionuclides at the same depth to obtain the relationship of cpm per pCi/g of each radionuclide.

Site Standard Operating Procedure for Down-Hole Measurements:

The detector is lowered down the bore hole using a cord marked off in half-foot intervals. The coaxial cable that transmits the detector signal to the analyzer that is to be used in the field will be the same detector/cable combination that is used during the calibration to ensure accurate calibration.

A typical background count rate with this detector is approximately 400 cpm. For a 30 second count, at least 200 counts are expected, resulting in less than 7% counting error.

1. Check that battery power of the NaI detector/SCA system is in acceptable range.

2. Check operation of the NaI detector by recording a background measurement and by recording a measurement using a Cs-137 check source placed end-on to the detector at a distance of six inches.

3. At the bore hole location, insert a hollow steel tube of sufficient length to reach the bottom of the bore hole. The tube acts as a sleeve that protects the detector and makes it easier to lower and retrieve.

4. Lower the detector in six inch intervals, stopping to take measurements for 30 seconds per interval. The first measurement is obtained at the ground surface; the last is obtained at the bottom of the sleeve.

72. Section 3.5, Page 3-6

The text should provide more details on how the surface water samples will be obtained.

Response: Additional details on surface water sampling have been included in the revised work plan. These details relate to when the samples are to be collected, the sample locations, and field monitoring to be performed when the samples are collected.

Surface water samples will be grab samples collected in appropriate laboratory cleaned containers. Sample collection and handling will be performed consistent with the procedures outlined in Section 4 of the SAP. Surface water samples will be collected

from the surface water body located immediately north of Area 2, and any other low-lying water drainage retention area which receives rainwater run-off from Areas 1 and 2, or potentially leachate from these areas. Sampling will be performed approximately three days after the end of a precipitation event in which an accumulation of greater than one inch is recorded at nearby Lambert Field airport. Sampling after a significant rainfall event will ensure that the majority of the water contained in these surface water bodies originates from the Site and is representative of surface run-off.

Samples from the surface water body north of Area 2 will be collected on the upstream side of the culvert which is located beneath St. Charles Rock Road, and also at the furthest upstream location which receives run-off or potential leachate from the Site. These surface water samples and samples from any other identified water body will be collected from mid-depth at a midstream location, so as to minimize the effects of surface aeration and bank turbulence. Sampling will begin with the most downstream sampling point and will proceed in an upstream direction. The samples will always be collected upstream from the sampler's position. The sample location and depth will be recorded in the field log book.

Temperature, pH, and specific conductance, hardness and dissolved oxygen will be measured in the field at each surface water location directly from the water body or in a separate beaker, as necessary. The samples will be collected by immersing either the sample container, or a clean stainless steel or glass beaker into the water. As noted, the water will be transferred from the beaker into the appropriate sample container in a manner that minimizes aeration.

73. Section 5.0, Page 5-1, second paragraph

The text states that soil and water samples to be analyzed for radionuclides which included radium-228. According to table 6-1 of the workplan radium-228 is not being analyzed. Please correct.

Response: Radium-228 will not be analyzed for and has been removed from the text statement.

74. Section 5.1, Page 5-1, fifth paragraph

This paragraph states that "it will be assumed that if all samples from a sampling area are below the chemical-specific detection limit, the chemical is not present in the sampling area." This last part of this sentence should be modified to read that the chemical is not present in the sampling area in the specific media sampled.

Response: The suggested modification has been made.

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75. The analytical laboratory should be identified and their standard operating procedures should be provided. The review of the laboratory which will be responsible for analyzing for radiological should be identified since radiological analysis is not part of the CLP program.

Response: The final selection of the laboratory (or laboratories) that will be performing the analyses has not been made. The Standard Operating Procedures for the selected laboratory, including radiological analyses, will be submitted to EPA prior to field investigations.

76. Section 2.2, Page 2-1

Refer to the workplan comments regarding the RI/FS Objectives defined in Section 5.1 of the workplan.

Response: The revisions to the RI/FS Objectives suggested in comment #28 have also been made to the list of objectives in the QAPP.

77. Section 3.4, Page 3-3, last paragraph

This paragraph states that "surface water sampling is not anticipated due to lack of surface water bodies at the Site." However, Section 3.5 of the FSP provides details of surface water sampling of the water body north of Area 2. Please correct.

Response: QAPP Section 3.4 has been modified to reflect the sampling of the north water body.

78. Section 4.2, Page 4-1, third paragraph

Surface water should be included in the list of samples to be collected.

Response: Surface water has been included in the list of samples to be collected in Section 4.2 of the QAPP.